

What is claimed is:

1. An apparatus for transmitting light comprising:
a first substrate having a first surface including at least one first optically active area;
a second substrate having a second surface positioned in opposing spaced apart relationship from said first surface, where said second surface has at least one second optically active area opposing said at least one first optically active area; and
a waveguide between said first and second optically active areas on said first and second surfaces, where said waveguide comprises a polymer core and a cladding for transmitting light therebetween.
2. The apparatus of claim 1, wherein said cladding comprises a second polymer, and wherein said first polymer is a photosensitive polymer.
3. The apparatus of claim 2, wherein said first polymer comprises a fluorinated polymer.
4. The apparatus of claim 1, wherein said first substrate is an optical circuit board.
5. The apparatus of claim 1 wherein each of said first and second substrates comprise a plurality of optically active areas.
6. The apparatus of claim 1 wherein the space between said first and second substrates is substantially filled with polymeric material.
7. The apparatus of claim 6 wherein one or more additional structures are embedded within said polymeric material.
8. The apparatus of claim 1, wherein said first and second surfaces are substantially parallel and spaced apart by a distance which is in the range of about 0.02 mm to about 0.15 mm.
9. The apparatus of claim 4, wherein said second substrate is an IC.
10. The apparatus claim 4, wherein said second substrate is a waveguide daughter board.
11. The apparatus of claim 1 wherein one of said optically active areas comprises a photodiode.
12. The apparatus of claim 1 wherein one of said optically active areas comprises a semiconductor laser.
13. A method of forming an optical interconnect between optically active areas on opposing surfaces of first and second spaced-apart substrates, comprising:
forming one or more waveguide cores on optically active areas of the first substrate from a photosensitive optical polymer, where said cores protrudes from said first substrate and have ends distal said substrate;

forming a waveguide cladding around said waveguide cores from a second polymer; and joining said second substrate to said distal ends of said waveguide cores after aligning optically active areas on second substrate with said waveguide cores.

14. The method claim 13, where said step of forming waveguide cores comprises:
coating at least a portion of said first substrate including with said photosensitive polymer;
partially curing said photosensitive polymer;
further curing selected areas of said photosensitive polymer using actinic radiation; and
removing the unexposed portions of said polymer.
15. The method claim 14, wherein said step of partial curing comprises soft baking.
16. The method claim 14, where said step of forming said waveguide cladding comprises:
coating at least a portion of said substrate surrounding said waveguide core with said second polymer; and
curing said second polymer.
17. The method of claim 16, wherein said cladding polymer is cured by heating.
18. The method of claim 13, further comprising the step of polishing said distal ends prior to joining them to said second substrate.
19. The method of claim 13, wherein said step of aligning precedes said step of forming said cladding.
20. The method of claim 13, wherein the opposing surfaces of said first and second substrates are about 0.02 mm to about 0.15 mm apart after being joined.
21. The method of claim 13, wherein said first substrate is an optical circuit board.
22. The method of claim 21, wherein said second substrate is an IC.
23. The method of claim 13, wherein at least one of said optically active areas comprises a photodiode, a semiconductor laser, or a light emitting diode.
24. The method of claim 13, wherein polymeric waveguide core material and polymeric cladding material occupies substantially the entire space between said opposing surfaces.
25. A method of forming an optical interconnect between optically active areas on spaced-apart opposing surfaces of first and second substrates, comprising:
depositing a photobleachable polymer over the optically active areas on said first substrate;
partially curing said photobleachable polymer;

emitting actinic radiation from the optically active areas on said first substrate to modify the refractive index of the overlying portions of said photobleachable polymer thereby forming waveguide core regions within said polymer; and

aligning the optically active areas on said second substrate with the waveguide core regions within said polymer,

joining said second substrate to said polymer.

26. The method of claim 25, wherein said step of bonding said second substrate comprises curing said polymer.

27. The method claim 25, wherein said polymer occupies substantially the entire volume between the opposing surfaces of said first and second substrates.

28. The method of claim 25 wherein said step of depositing a photobleachable polymer over the optically active areas on said first substrate comprising depositing a polymer ball over each optically active area.

29. The method of claim 25, wherein said opposing surfaces of said first and second substrates are generally planar and are spaced apart by a distance within the range of about 0.02 mm to about 0.15 mm.

30. The method of claim 25, wherein one substrate is an optical circuit board.

31. The method of claim 30, wherein the other substrate is an IC.

32. The method of claim 30, at least one of said optically active areas comprises a photodiode, a semiconductor laser or a light emitting diode.